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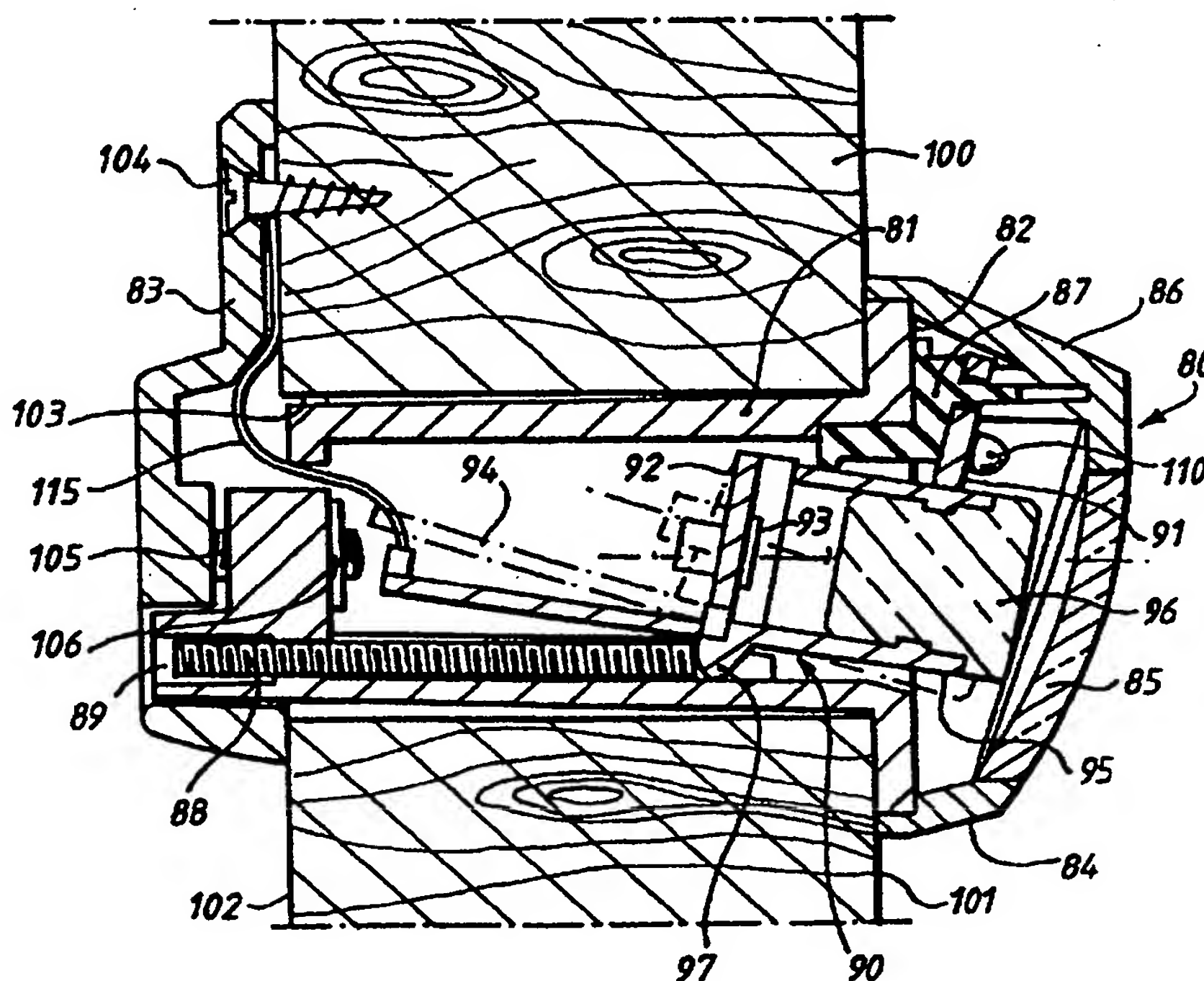
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**(54) Title: MINIATURE CAMERAS****(57) Abstract**

A miniature camera (80) is fitted to a door (100), and comprises an elongate tubular housing (81) which extends between an outer face (101) and an inner face (102) of the door (100). An annular flange (82) is formed at one end of the housing (81), and bears against the outer face (101) of the door (100). An end cap (83) is secured to the inner door face (102) by means of a wood screw (104), and is connected to the housing (81) by means of a bolt (105). A cover (84) is provided with a transparent portion (85), and engages the housing (81) in a substantially waterproof and weatherproof manner. Mounted within the tubular housing (81) is a chassis member (90), which cooperates with a resilient member (87). Mounted on the chassis (90), substantially at right angles thereto, is a circuit board (92) which carries a CMOS/APS image sensor (93). A second circuit board (94) is also mounted on the chassis member (90), and extends in a direction generally parallel to the axis of extent of the chassis member (90). An adjusting screw (88) is mounted at the lower part of the tubular housing (81), and engages a projection (97) to adjust the angle of inclination of the chassis member (90), against a resilient bias of the resilient member (87). Cameras of other configurations are disclosed in the specification.



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MINIATURE CAMERAS

5 This invention relates to cameras and is concerned particularly, although not exclusively, with miniature cameras.

10 Miniature cameras are finding increasing application in surveillance and security systems, and also in automated inspection apparatus, and for incorporation in other devices. In such systems, it is often desirable for a camera to be as small as possible, so that it may be located discretely in such a way that it is not readily observed.

15 Preferred embodiments of the present invention aim to provide miniature cameras which can be so constructed as to be particularly small and compact, and may find application in fields as mentioned above.

20 According to one aspect of the present invention, there is provided a camera adapted to be mounted in a panel having first and second faces, the camera comprising:

25 an elongate tubular housing;  
securing means for securing the said housing to a respective said panel, with the housing extending through the panel between said first and second faces;  
30 a chassis member mounted within said housing;  
an image sensor mounted on said chassis; and  
a lens for focusing an image onto said sensor.

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Preferably, said housing extends along a first axis, said chassis member defines a second axis on which said lens and sensor are aligned, and adjustment means is provided for adjusting the angle between said first and second axes.

Said securing means may include a circular flange at one end of said housing which, in use, bears against one of said faces.

Preferably, said securing means includes an end cap which is secured, in use, to one of said faces, and fastening means for fastening said end cap to said housing.

A camera as above may include a cover which is secured to one end of said housing and has at least a transparent portion to allow the transmission therethrough of light to said lens.

Preferably, said sensor is mounted on a first printed circuit board which extends generally at right angles to an axis of said chassis member, and said first printed circuit board is connected to a second printed circuit board which is mounted on said chassis member and extends generally parallel to said axis of extent.

The invention extends to a camera as above, when secured in a door.

According to another aspect of the present invention, there is provided a camera comprising:

a printed circuit board;

an image sensor mounted on the printed circuit board; and

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first and second parts which interengage to clamp the printed circuit board therebetween, with the image sensor in a position to receive an image through an aperture in the housing.

5

Preferably, said housing parts are of substantially circular cross-section.

10

Preferably, said housing parts are formed with a cavity of substantially circular cross-section, to receive the printed circuit board and parts thereon.

Said housing parts may interengage in a screw-threaded manner.

15

Preferably, said housing comprises a third part which interengages with the first or second housing part and carries, or is adapted to carry, a lens to focus an image on said image sensor.

20

Said housing may be adapted to receive interchangeable lenses.

25

Preferably, said printed circuit board is substantially circular in plan.

Said housing may be of a generally ovoid shape.

30

Said housing may be mounted on a stand, and be movable with respect to the stand.

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According to a further aspect of the present invention, there is provided an image sensor assembly for a miniature camera, the assembly comprising a printed circuit board and, mounted thereon, the image sensor, a video processor,

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an audio processor, and a voltage regulator to accept a plurality of different input voltages and provide a substantially constant supply voltage to components on the printed circuit board.

5

According to another aspect of the present invention, there is provided a sensor assembly for a miniature camera, comprising an image sensor mounted on a printed circuit board of substantially circular shape.

10

In a camera or sensor according to any of the preceding aspects of the invention, said image sensor is preferably a CMOS sensor.

15 Preferably, said image sensor is an active pixel sensor.

A camera as above may include infra-red emitting means on or adjacent a front face of the camera, for illuminating a subject to be viewed by the camera.

20

A camera as above may incorporate a battery or voltage transformer means.

25 A camera as above may incorporate a radio transmitting means for transmitting video signals from the camera.

A camera as above may incorporate a video modulator.

30 A camera as above may incorporate a circuit for processing a signal received from an external PIR detector, to activate the camera in response to such a signal.

A camera as above may incorporate a microphone and/or loudspeaker mounted in or on the housing.

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A camera as above may be a miniature camera.

Preferably, the maximum dimension of the camera is not greater than 100, 80 or 50 mm.

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According to a further aspect of the present invention, there is provided a sensor assembly comprising an image sensor mounted on a circuit board and lens holder that engages the circuit board and holds a lens at a predetermined distance from the sensor.

10

According to another aspect of the present invention, there is provided a surveillance system comprising a camera, a monitor, and a cabling system to connect the camera with the monitor, the cabling system comprising:

15

a plurality of socket connectors at different locations, each having at least a first socket to receive a plug from said camera, and at least one of the socket connectors having a second socket to receive a plug from said monitor; and

20

cabling which connects said first sockets in parallel and connects said second sockets, if more than one, in parallel.

25

Preferably, each of said socket connectors is in the form of a connection box of a type used with telephones in the area in which the surveillance system is installed.

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A surveillance system as above may further comprise a power supply which is connected to supply power to said first sockets and/or to said second socket(s).

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Each of said first sockets may comprise a plurality of terminals, each to receive a respective video signal, and switching means may be provided to switch between said terminals, and connect a selected one of said terminals to  
5 the or each said second socket.

Preferably, said switching means is disposed in one of said socket connectors.

10 A surveillance system as above may include means for programming and/or controlling said switching means.

A surveillance system as above may include a camera according to any of the preceding aspects of the  
15 invention.

For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the  
20 accompanying diagrammatic drawings, in which:

Figures 1A to 1C illustrate respectively a front portion, centre portion and rear portion of a miniature camera housing;  
25

Figure 2 illustrates a housing assembled of the parts of Figures 1A to 1C;

Figure 3 is a perspective view of a camera having a  
30 housing similar to that of Figure 2, mounted on a stand;

Figure 4 is a longitudinal sectional view through a miniature camera fitted to a door;

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Figure 5 is a perspective view of the camera of Figure 4, when not fitted to a door;

Figure 6 is a schematic diagram of a camera surveillance system with a cabling system; and

Figure 7 shows a lens holder for a lens and an image sensor.

10 The miniature camera 50 that is shown in Figure 2 comprises a housing made of a front portion 10, centre portion 20 and rear portion 30, that are shown individually in Figures 1A to 1C respectively. All of the housing portions 10, 20 and 30 are of substantially  
15 circular cross-section.

The centre portion 20 comprises a central bore 21 which communicates with a front bore 22 and an intermediate bore 23 which, in turn, communicates with a rear bore 24. The  
20 central bore 21 is of slightly smaller diameter than the front bore 22 and intermediate bore 23, so as to define respective annular shoulders 25 and 26 therewith. The rear bore 24 is of larger diameter than the intermediate bore 23, thereby to define an annular shoulder 27  
25 therewith. A radially extending passage 28 is formed to open into the outer face of the central portion 20, and communicates with the central bore 21 via an orifice 29. Both the front bore 22 and the rear bore 24 are formed with internal screw-threads. Preferably, the screw-thread  
30 of the front bore 22 is to take a standard photographic lens mount - for example, in the UK, known as a standard photographic C-mount or CS-mount.

The front housing portion 10 is formed with a central bore  
35 11 and a front bore 12. The bore 12 is of slightly larger

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diameter than the central bore 11, to form an annular shoulder 13 therewith. The rear part of the front housing portion 10 is formed as a boss 14 which is provided with an external screw-thread 14 to match that of the front  
5 bore 22 of central housing portion 20.

The rear housing portion 30 is formed with a central bore 31, and two rear bores 32 and 33 of progressively reducing diameter, to define respective annular shoulders between  
10 successive bores. The front part of the rear housing portion 30 is formed as a boss 34 which is provided with an external screw-thread to match that of the rear bore 24 of the central housing portion 20.

15 In use, the front and rear housing portions 10 and 30 screw-threadedly engage the central housing portion 20. To this end, the external screw-thread on the boss 14 on the front portion 10 engages the screw-thread 22 of the central housing portion 20, and the external thread of the  
20 boss 34 of the rear housing portion 30 engages with the internal thread of the rear bore 24 of the central housing portion 20.

A sealing member (e.g. an O-ring) may be provided on the  
25 front portion 10 and/or the central portion 20, to provide sealing between those housing portions. Similarly, a sealing member (e.g. an O-ring) may be provided on the rear portion 30 and/or the central portion 20, to provide sealing between those housing portions.

30 Figure 2 shows the three housing portions 10, 20 and 30 engaged with one another, to make up the housing, which is generally ovoid, or egg-shaped. An image sensor 51 is mounted on a circular printed circuit board 52, which  
35 engages within the intermediate bore 23 in the central

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- housing portion 20, and is clamped in position there by the rear housing portion 30, which interengages with the centre housing portion 20, and bears against the circuit board 52, which is slightly thicker than the axial extent of the intermediate bore 23. A further printed circuit board 53 is mounted on the first printed circuit board 52, substantially at right angles thereto. Various circuitry components are mounted on the circuit board 53, to provide power to the image sensor 51, process image signals received therefrom, and also to process audio signals from a miniature microphone 54 which is mounted within the radially extending passage 28 and connected to the printed circuit board 52 and/or 53. A cable 55 is connected to the printed circuit board 53, and passes through the rear bores 32, 33, to provide a connection between the miniature video camera 50 and external processing circuitry (not shown). A cable clamp 56 is provided in the rear bore 32 of the rear housing part 30.
- 20 A single circuit board (e.g. circular) may be provided, instead of the two circuit boards 52 and 53.

25 A wide-angle lens 57 is mounted in the front bore 12 of the front housing portion 10, and bears against the annular abutment shoulder 13. The lens 57 is so positioned as to focus an image onto the image sensor 51. If desired, the front housing portion 10 may be unscrewed, and replaced by a standard photographic lens mount.

- 30 Due to the configuration of the various components, the miniature camera 50 may have very small dimensions. For example, the maximum diameter of the housing may be 38mm, and the overall length of the housing may be 38mm.

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The image sensor 51 is preferably of a CMOS/APS (Active Pixel Sensor) type. An APS acts similarly to a random access memory (RAM) device, wherein each pixel contains its own selection and readout transistors. Further  
5 information on APS-type sensors may be found in the publication "Laser Focus World", June 1993, Page 83.

10 Instead of the hard-wired cable connection by means of the cable 55, there may be provided a radio, infra-red or other transmitter within the rear housing portion 30, in order to provide a remote link from the camera 50 to a receiver and signal processing equipment. If desired, the rear housing portion 30 may be replaced by another portion  
15 of different configuration, designed to accommodate additional components or different components of different configurations. For example, there may be provided within the housing 50 sufficient room to house a battery, and/or a transmitter, and/or a converter in order to convert a video signal or combined video/audio signals into a UHF  
20 signal.

If desired, a miniature loudspeaker may be built into the housing 50 - for example, in a manner similar to the miniature microphone 54.

25

Figure 3 shows a miniature camera 60, which is generally similar to the camera 50 of Figures 1 and 2. In Figure 3, the camera 60 comprises a housing 61 which is mounted on a stand 70 comprising a base 71 and an upstanding arm 72.  
30 The housing 61 is mounted at the top of the arm 72 by a pivot pin 73, which engages with both the top of the arm 72 and the housing 61 of the camera 60. Thus, the camera 61 can pivot upwardly and downwardly (as seen), with respect to the arm 72. The arm 72 may carry a cylindrical

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boss which engages in a corresponding cylindrical recess in the housing of the camera 60, for stability.

5 If desired, the arm 72 may be pivotally mounted on the base 71, so that it may pivot around a substantially vertical axis (as seen in Figure 3) to provide another degree movement of the camera 60. The base 71 may be formed with a fixing hole for a screw or the like.

10 Thus, the arrangement of the camera 60 on the stand 72 may permit the camera to be flexibly positioned, but such that the image sensor is always the correct way up so that the image received by the sensor appears the correct way up on a monitor.

15

The base 71 and arm 72 may be separate pieces, or formed as one piece. The base 71 may be dispensed with.

20 Figure 4 shows a miniature camera 80 fitted to a door 100. The camera 80 comprises an elongate tubular housing 81 which extends between an outer face 101 and an inner face 102 of the door 100. The door 100 is drilled with a circular hole 103 (for example, of a diameter of 25mm), through which the housing 81 passes.

25

An annular flange 82 is formed at one end of the housing 81, and bears against the outer face 101 of the door 100. As may be seen in Figure 4, the housing 81 tapers slightly towards the inner face 101 of the door 100, in order to provide sufficient clearance within the hole 103. An end cap 83 is secured to the inner door face 102 by means of a wood screw 104, and is connected to the housing 81 by means of a bolt 105 which engages a captive nut 106 provided on the housing 81.

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In order to fit the camera 80 to the door 100, the hole 103 is first drilled through the door 100, and the elongate tubular housing 81 is passed through the hole 103, to engage therein, until the annular flange 82 bears  
5 against the outer door face 101. The end cap 83 is engaged with the tubular housing 81 by means of the bolt 105, which is tightened until the end cap 83 bears firmly against the inner door face 102, with the housing 81 positioned substantially centrally within the hole 103.  
10 The end cap 83 is then secured firmly to the inner door face 102, by means of the wood screw 104. It will be appreciated that the provision of the fixing bolt 105 enables the camera 80 to be fitted to doors of differing thicknesses. If desired, bolts 105 of differing lengths  
15 can be suitably provided.

Mounted on the outer end of the housing 81 is a cover 84 which is provided with a transparent portion 85, and engages the housing 81 in a substantially waterproof and  
20 weatherproof manner.

Mounted within the tubular housing 81 is a chassis member 90, which is connected to an internal member 86 of the cover 84, by means of a connecting member 91. A resilient  
25 member 87 (eg of elastomeric material) is positioned between the annular flange 82 and the connecting member 91, and bears against an outer surface of the chassis member 90.

30 Mounted on the chassis 90, substantially at right angles thereto, is a circuit board 92 which carries a CMOS/APS image sensor 93. A second circuit board 94 is also mounted on the chassis member 90, and extends in a direction generally parallel to the axis of extent of the  
35 chassis member 90, and substantially at right angles to

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the first circuit board 92. The chassis member 90 comprises a substantially tubular portion 95, in which there is mounted a lens assembly 96, at a predetermined distance from, and substantially coaxial with the image sensor 93. The tubular portion 95 presents an external surface against which the resilient member 87 bears, and is formed with a projection 97 which bears against an inner surface of the tubular housing 81. An elongate adjusting screw 88 is mounted at the lower part (as seen) of the tubular housing 81, and engages the projection 97. One end of the adjustment screw 88 is accessible via an aperture 89 provided at the rear end (as seen) of the tubular housing 81.

15 The resilient member 87 provides a resilient bias which acts to tilt the chassis member 90 downwardly, to pivot clockwise about the abutment 97, as seen in the drawing. Thus, the general axis of the lens and image sensor on the chassis member 90 defines an angle with the general axis of extent of the tubular housing 81, so that the lens and sensor are angled generally downwardly, with respect to the door 100. The extent to which the chassis member 90 is so angled depends upon the position of the adjusting screw 88, which bears against the projection 97. By adjusting the adjustment screw 88, the angle of inclination of the chassis member 90 may be adjusted. A series of LEDs (optional) are arrayed on the connecting member 91, at least partly around the lens assembly 96, to point forwardly through the cover 84. These provide infra-red light, to which the image sensor 93 is responsive, in order that objects may be viewed by the camera 80 at night.

A connector 115 is connected to the circuit board(s) 94 and/or 92, and to a flat ribbon connector 116 (or other

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connector), which connects the camera 80 to a receiving and image processing apparatus (eg TV monitor, video recording device, etc - not shown).

- 5 Instead of the two circuit boards 92 and 94, a single circuit board such as 92 may be provided.

Figure 5 shows the miniature camera 80, when not fitted to the door 100.

10

It may be appreciated that the camera 80 may be readily fitted to a door (or other panel) in a quick and simple manner and provide a reliable surveillance means of a discrete size. It is particularly useful to arrange the circuit boards 92 and 94 in a manner generally as illustrated, in order to best utilise the space available within the tubular housing 81, and thereby enable the housing 81, and overall dimensions of the camera 80, to be as small as possible. Many of the parts of the camera 80 may be manufactured readily as moulded plastic parts, and therefore be relatively cheap, light and durable.

15

20

As for the embodiment of Figures 1 and 2, the camera 80 may readily incorporate a miniature microphone and/or loudspeaker. The front cover 84 of the camera 80 may be adapted to house a PIR (passive infra-red) detector, in order to detect movement of bodies in front of the camera 80. The end cap 83 may be replaced with end caps of different configurations - especially if it is desired to incorporate different items of apparatus, such as a battery, radio transmitter, video/UHF converters, different cabling options, PIR signal processing circuitry, etc.

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The chassis 90 with lens and sensor may find more general application, in other camera apparatus.

5 The surveillance system 150 that is shown in Figure 6 comprises a camera 152, which may, for example, be generally similar to the camera 50 shown in Figures 1 and 2 and/or the camera 60 shown in Figure 3. A video monitor or TV 154 is provided, to display a signal received from the camera 152. Optionally, the monitor 154 may also  
10 include a loudspeaker system for playing audio signals received from the camera 152.

The camera 152 and monitor 154 are connected by means of a cabling system 160. The cabling system comprises a  
15 plurality of socket connectors 161 and 162, provided at different physical locations. Each of the socket connectors 161, 162 is provided with a first socket 163 for receiving a plug 153 from the camera 152. The socket connector 162 is provided also with a second socket 165,  
20 to receive a plug 155 from the monitor 154. The plug 155 is connected to a plurality of connectors 156, which may include, for example, phono plug and a SCART-type connector, in order to connect to the monitor 154.

25 One of the socket connectors (in this case the socket connector 162) is also provided with a third socket 166 which receives a plug 176 connected to a power supply device 170. The power supply device 170 may comprise, for example, a low-voltage transformer in order to receive  
30 mains power and provide, as an output, a low (eg 12 volt) operating voltage for the camera 152.

All of the first sockets 163 are connected in parallel, and each of them includes a terminal to which the low  
35 voltage power from the socket 166 is supplied. The first

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sockets 163 are connected to the second socket 165, either directly, or via a switching device (not shown).

5 In use, the camera 152 may be plugged into the first socket 163 of any of the socket connectors 161, 162. Since all of these are connected in parallel, each of them appears identical to the camera 152. As mentioned above, power is supplied to the camera 152 from the power supply device 170, via the socket 166 and respective socket 163.

10 The monitor 154 is connected to the socket connector 162 via the connectors 155 and 156, and as mentioned above, a connection is made to the first sockets 163. In this way, the camera 152 may be connected to the monitor 154 by plugging in the camera plug 153 to any desired one of the

15 first sockets 163, which are provided at different locations in the area in which the surveillance system 150 is installed.

Each of the socket connectors 161, 162 is in the form of

20 a connection box of a type used with telephones in the area in which the surveillance system 150 is installed. Thus, for example, in the UK, each of the socket connectors 161, 162 could comprise a conventional BT (British Telecom) telephone connection box. In addition

25 to being able to use such readily available connection boxes, this has the advantage that the connection points for the camera 152 are discrete to an observer, and may not readily be recognised as part of a surveillance system.

30

Power for elements of the surveillance system may be derived from a local telephone circuit.

If desired, all of the socket connectors may be of a twin

35 type, such as the socket connector 162, in order that a

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monitor 154 may be connected at any desired location. If desired, power may be supplied also to the second socket(s) 165, in order to supply power to a monitor, which need not be a mains powered monitor, but may be a small low-voltage monitor.

In the above-mentioned example of BT connectors, there are typically six conductors available for the respective plugs and sockets. Thus, in such an example, up to four different cameras may be plugged in at any desired locations. For example, of the six conductors available, one may be used as a common ground, another as a low-voltage supply, and the remaining four as four separate video lines. If four different cameras such as 152 are provided, each one using a different one of four lines, each camera may be plugged in selectively at any desired one of the socket connectors, to supply its respective video signal along its respective video line.

If desired, the socket connector 162 may contain a switching device to switch selectively between a plurality of cameras such as 152, connected to a plurality of connectors such as 161. Such a switching device may cycle automatically by a predetermined programme. Alternatively, it may be user-programmable. To this end, a remote or wire link may be provided to the respective socket connector 162, in order that a user may input commands to program the switching operation. Alternatively or additionally, the monitor 154 may be provided with a remote or wired link to a user control, and provide program instructions to the switching device in the socket connector 162.

The monitor 154 may comprise a domestic television set. With the video signals provided from the camera 152 as

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either video or UHF signals, viewing of an image from the camera 152 may be selected on the television at will, and need not interrupt normal television viewing.

- 5 Any of the cameras mentioned above may be connected to a cable TV system. For example, domestic installations of cable TV often have a terminal box, which may be located near the front door of the dwelling. Any of the cameras mentioned above may be connected to such a terminal box,
- 10 in order to distribute the video signals from the camera(s) to the or each TV in the dwelling.

- Figure 7 shows an image sensor 201 (e.g. of APS type), engaged with a lens holder 202 of plastics material, with
- 15 an aperture 203 to receive a lens 204. With the holder 202 and lens 204 mounted together, the holder 202 serves to hold the lens 204 at a fixed, predetermined distance from the sensor 201, in order properly to focus an image onto the sensor 201. The light-sensitive area on the
- 20 sensor 201 is located asymmetrically on the sensor, and the aperture 203 is positioned asymmetrically on the lens holder 202, in order to match the asymmetry of the sensor 201.

- 25 In this specification, terms of absolute orientation are used conveniently to denote the usual orientation of items in normal use and/or as shown in the accompanying drawings. However, such items could be disposed in other orientations, and in the context of this specification,
- 30 terms of absolute orientation, such as "top", "bottom", "left", "right", "vertical" or "horizontal", etc. are to be construed accordingly, to include such alternative orientations.

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5 The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

10 All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

15 Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each  
20 feature disclosed is one example only of a generic series of equivalent or similar features.

25 The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

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**CLAIMS:**

1. A camera adapted to be mounted in a panel having first and second faces, the camera comprising:

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an elongate tubular housing;

securing means for securing the said housing to a respective said panel, with the housing extending through the panel between said first and second faces;

10

a chassis member mounted within said housing;

an image sensor mounted on said chassis; and

15

a lens for focusing an image onto said sensor.

2. A camera according to claim 1, wherein said housing extends along a first axis, said chassis member defines a second axis on which said lens and sensor are aligned, and adjustment means is provided for adjusting the angle between said first and second axes.

20

3. A camera according to claim 1 or 2, wherein said securing means includes a circular flange at one end of said housing which, in use, bears against one of said faces.

25

4. A camera according to claim 1, 2 or 3, wherein said securing means includes an end cap which is secured, in use, to one of said faces, and fastening means for fastening said end cap to said housing.

30

5. A camera according to any of claims 1 to 4, including a cover which is secured to one end of said housing and

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has at least a transparent portion to allow the transmission therethrough of light to said lens.

5 6. A camera according to any of claims 1 to 5, wherein said sensor is mounted on a first printed circuit board which extends generally at right angles to an axis of said chassis member, and said first printed circuit board is connected to a second printed circuit board which is mounted on said chassis member and extends generally  
10 parallel to said axis of extent.

7. A camera according to any of claims 1 to 6, when secured in a door.

15 8. A camera comprising:

a printed circuit board;

an image sensor mounted on the printed circuit board; and  
20 first and second parts which interengage to clamp the printed circuit board therebetween, with the image sensor in a position to receive an image through an aperture in the housing.

25

9. A camera according to claim 8, wherein said housing parts are of substantially circular cross-section.

30 10. A camera according to claim 8 or 9, wherein said housing parts are formed with a cavity of substantially circular cross-section, to receive the printed circuit board and parts thereon.

35 11. A camera according to claim 8, 9 or 10, wherein said housing parts interengage in a screw-threaded manner.

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12. A camera according to any of claims 8 to 11, wherein said housing comprises a third part which interengages with the first or second housing part and carries, or is adapted to carry, a lens to focus an image on said image sensor.

13. A camera according to any of claims 8 to 12, wherein said housing is adapted to receive interchangeable lenses.

14. A camera according to any of claims 8 to 13, wherein said printed circuit board is substantially circular in plan.

15. A camera according to any of claims 8 to 14, wherein said housing is of a generally ovoid shape.

16. A camera according to any of claims 8 to 15, wherein said housing is mounted on a stand, and is movable with respect to the stand.

17. An image sensor assembly for a miniature camera, the assembly comprising a printed circuit board and, mounted thereon, the image sensor, a video processor, an audio processor, and a voltage regulator to accept a plurality of different input voltages and provide a substantially constant supply voltage to components on the printed circuit board.

18. A sensor assembly for a miniature camera, comprising an image sensor mounted on a printed circuit board of substantially circular shape.

19. A camera or sensor according to any of the preceding claims, wherein said image sensor is a CMOS sensor.

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20. A camera or sensor according to any of the preceding claims, wherein said image sensor is an active pixel sensor.
- 5 21. A camera according to any of the preceding claims, including infra-red emitting means on or adjacent a front face of the camera, for illuminating a subject to be viewed by the camera.
- 10 22. A camera according to any of the preceding claims, incorporating a battery or voltage transformer means.
23. A camera according to any of the preceding claims, incorporating a radio transmitting means for transmitting  
15 video signals from the camera.
24. A camera according to any of the preceding claims, incorporating a video modulator.
- 20 25. A camera according to any of the preceding claims, incorporating a circuit for processing a signal received from an external PIR detector, to activate the camera in response to such a signal.
- 25 26. A camera according to any of the preceding claims, incorporating a microphone and/or loudspeaker mounted in or on the housing.
27. A camera according to any of the preceding claims,  
30 being a miniature camera.
28. A camera according to claim 27, wherein the maximum dimension of the camera is not greater than 100, 80 or 50 mm.

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29. A sensor assembly comprising an image sensor mounted on a circuit board and lens holder that engages the circuit board and holds a lens at a predetermined distance from the sensor.

5

30. A camera or image sensor assembly substantially as hereinbefore described with reference to Figures 1 and 2, Figure 3, Figures 4 and 5, or Figure 7 of the accompanying drawings.

10

31. A surveillance system comprising a camera, a monitor, and a cabling system to connect the camera with the monitor, the cabling system comprising:

15 a plurality of socket connectors at different locations, each having at least a first socket to receive a plug from said camera, and at least one of the socket connectors having a second socket to receive a plug from said monitor; and

20

cabling which connects said first sockets in parallel and connects said second sockets, if more than one, in parallel.

25 32. A surveillance system according to claim 31, wherein each of said socket connectors is in the form of a connection box of a type used with telephones in the area in which the surveillance system is installed.

30 33. A surveillance system according to claim 31 or 32, further comprising a power supply which is connected to supply power to said first sockets and/or to said second socket(s).

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34. A surveillance system according to claim 31, 32 or 33, wherein each of said first sockets comprises a plurality of terminals, each to receive a respective video signal, and switching means is provided to switch between  
5 said terminals, and connect a selected one of said terminals to the or each said second socket.

35. A surveillance system according to claim 34, wherein said switching means is disposed in one of said socket  
10 connectors.

36. A surveillance system according to claim 34 or 35, including means for programming and/or controlling said switching means.  
15

37. A surveillance system substantially as hereinbefore described with reference to Figure 6 of the accompanying drawings.

20 38. A surveillance system according to any of claims 31 to 37, including a camera according to any of claims 1 to 30.

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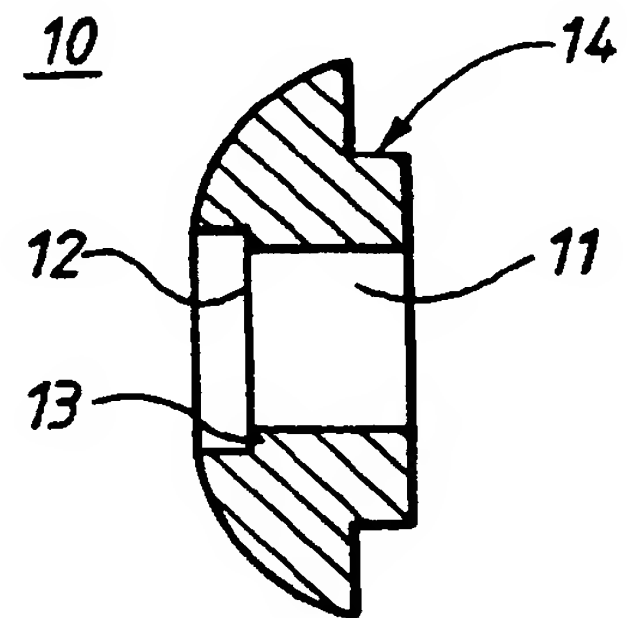
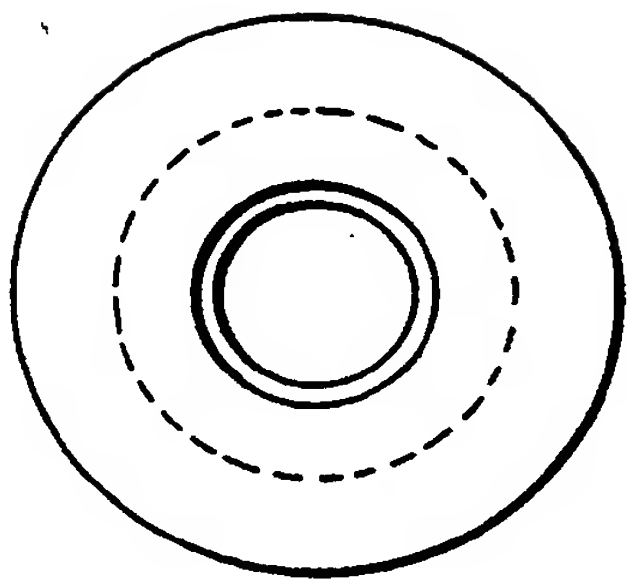


Fig.1A.

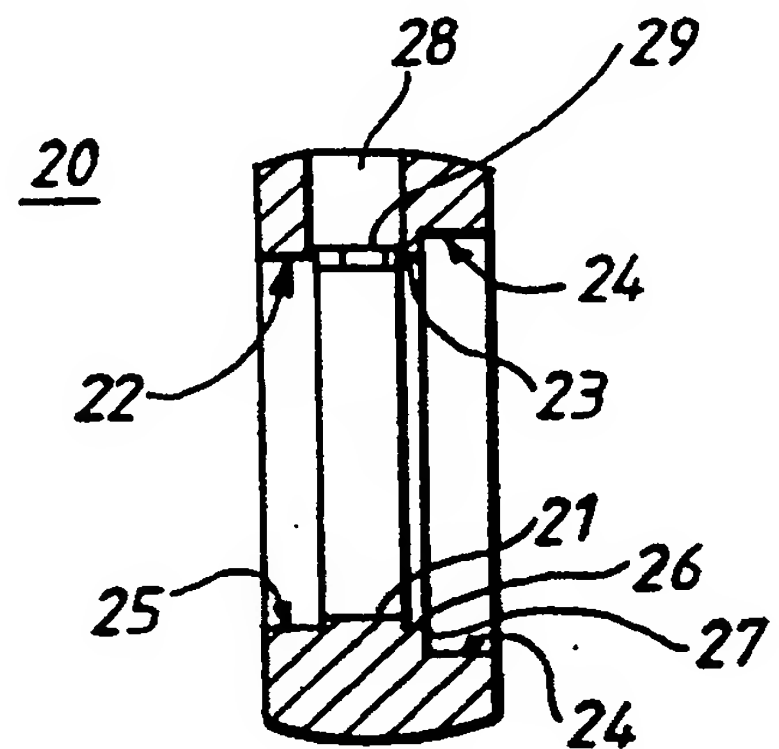
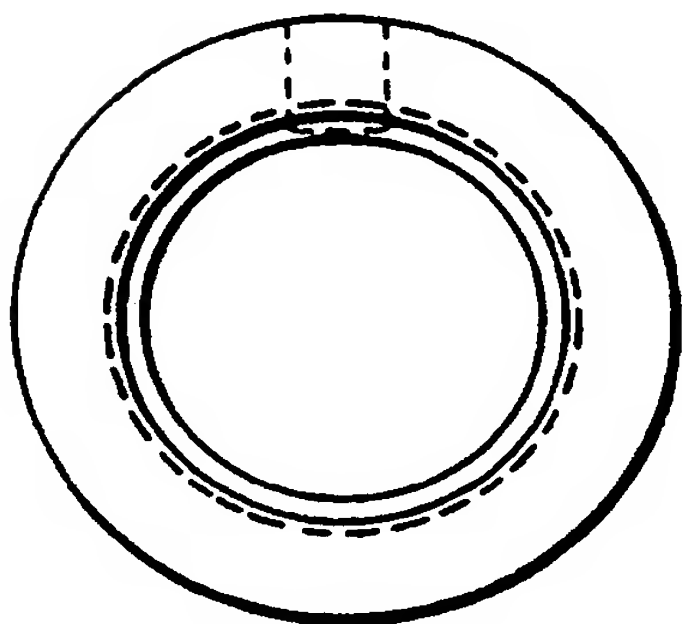
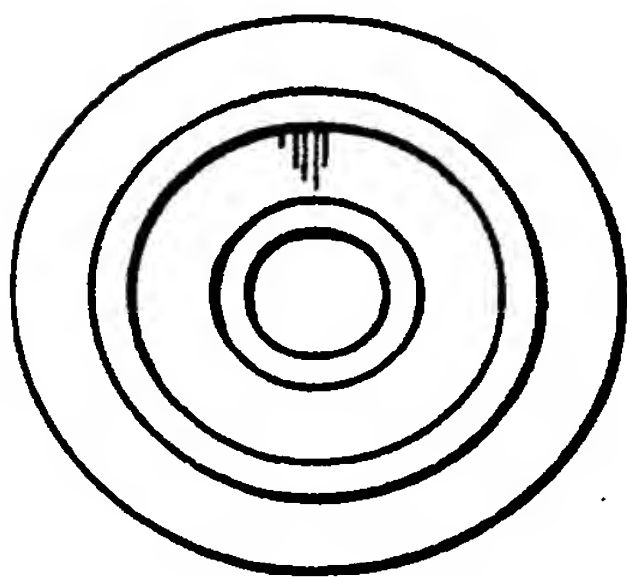


Fig.1B.



30

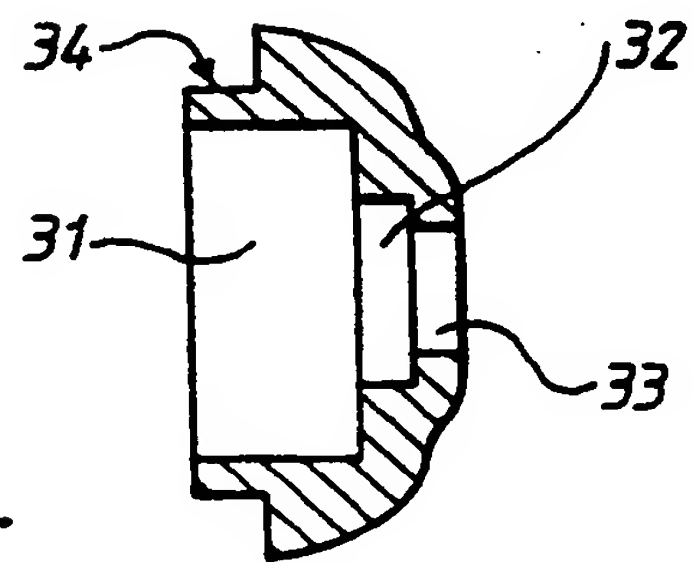


Fig.1C.

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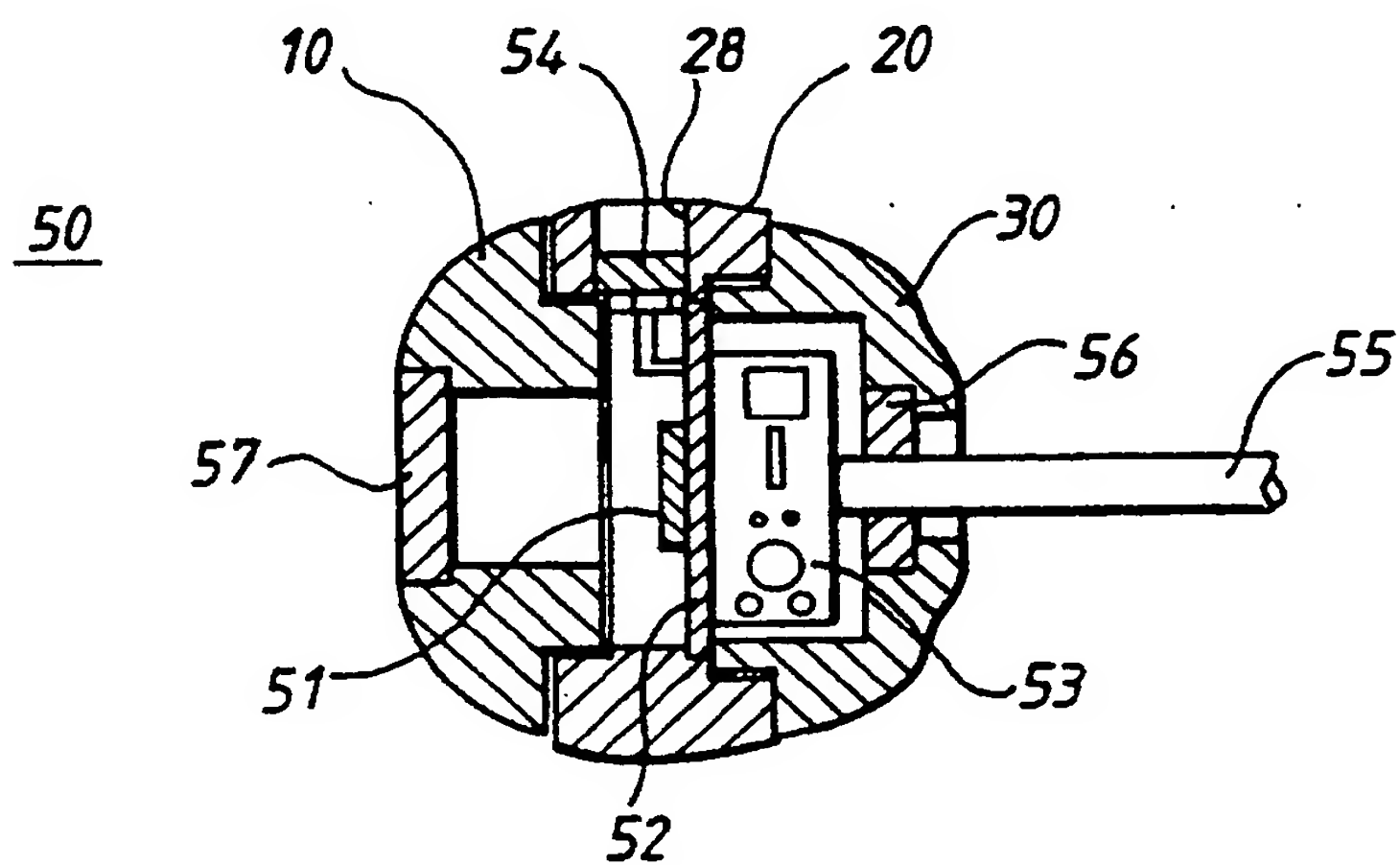


Fig.2.

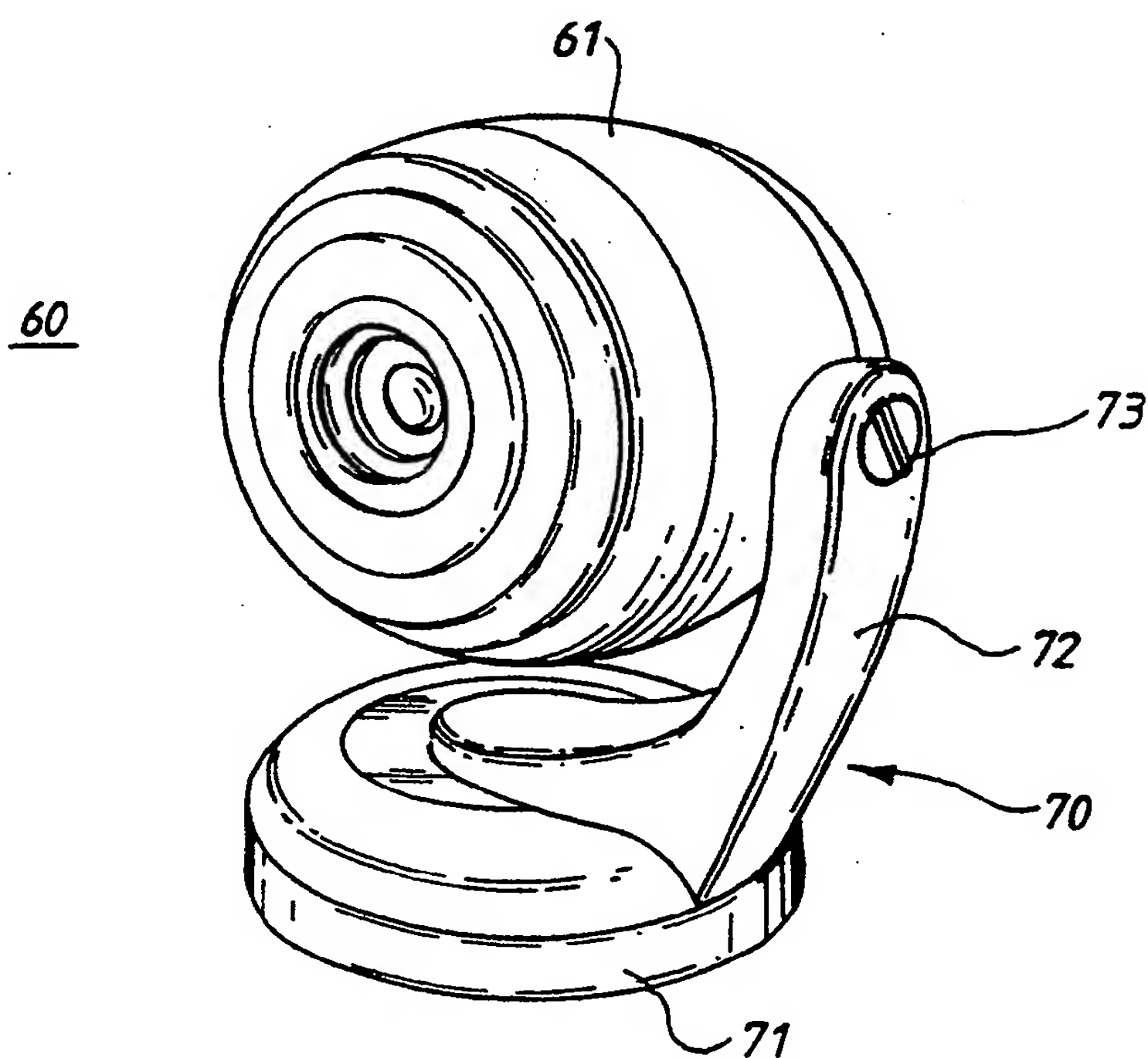


Fig.3.

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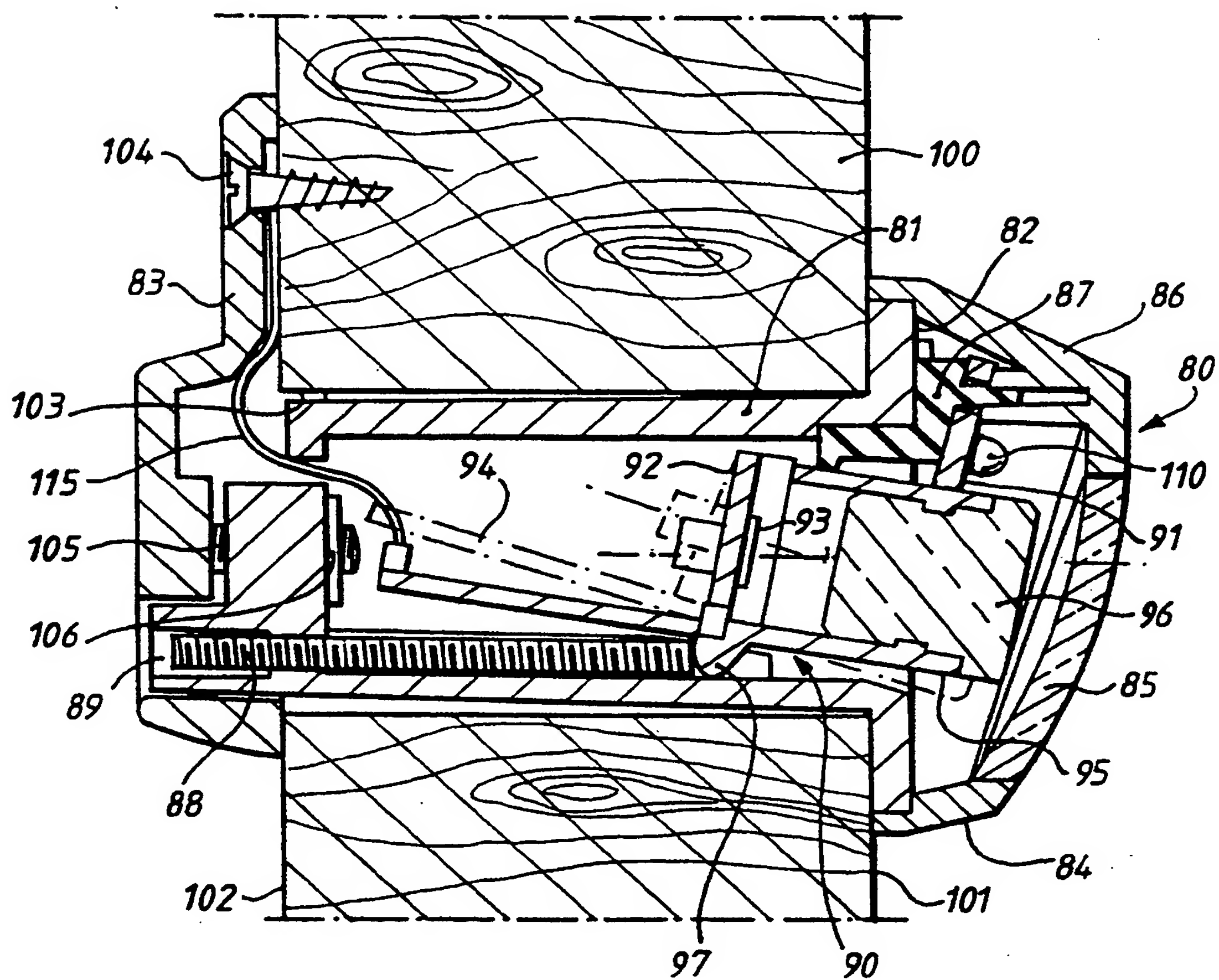


Fig. 4.

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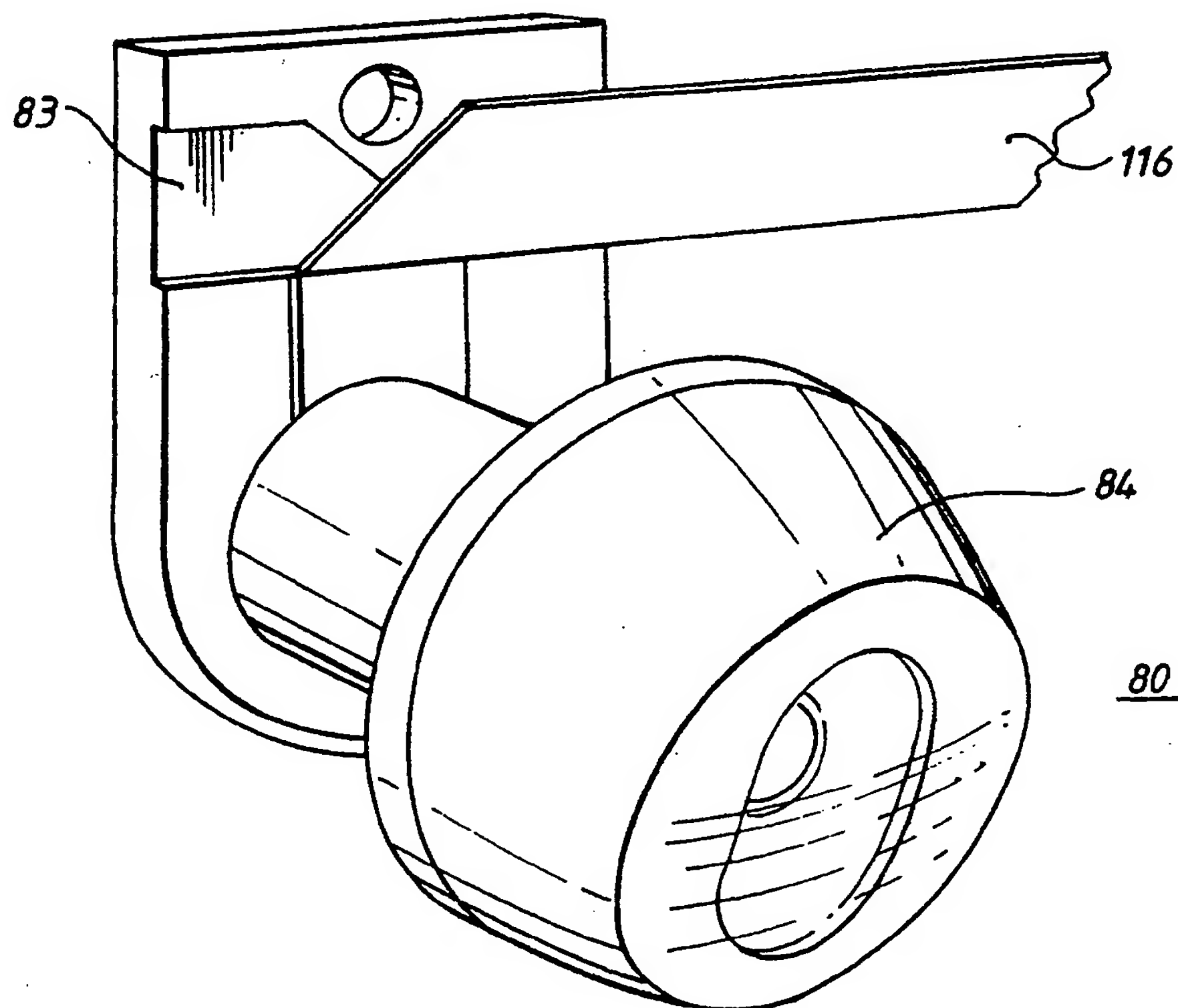


Fig.5.

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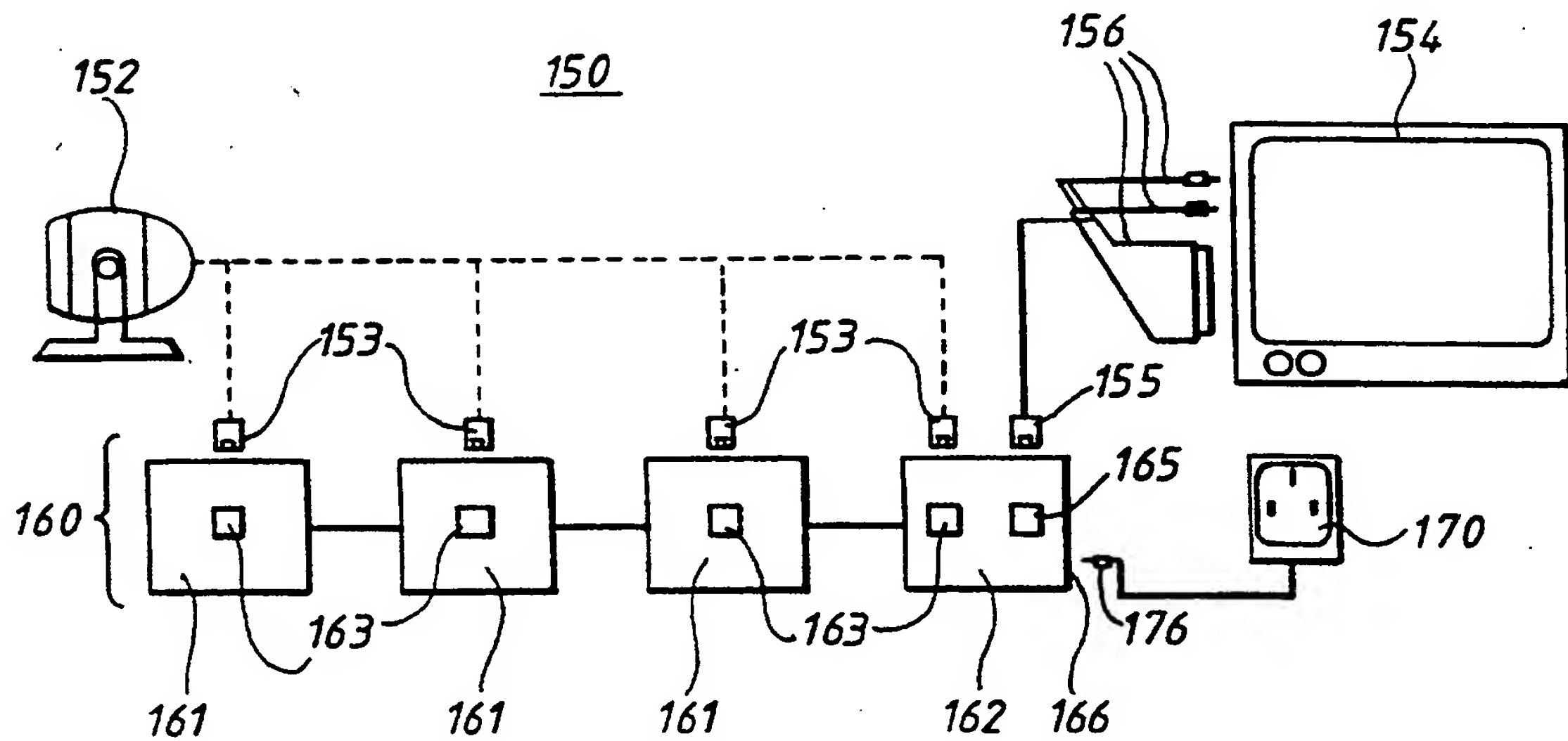


Fig. 6.

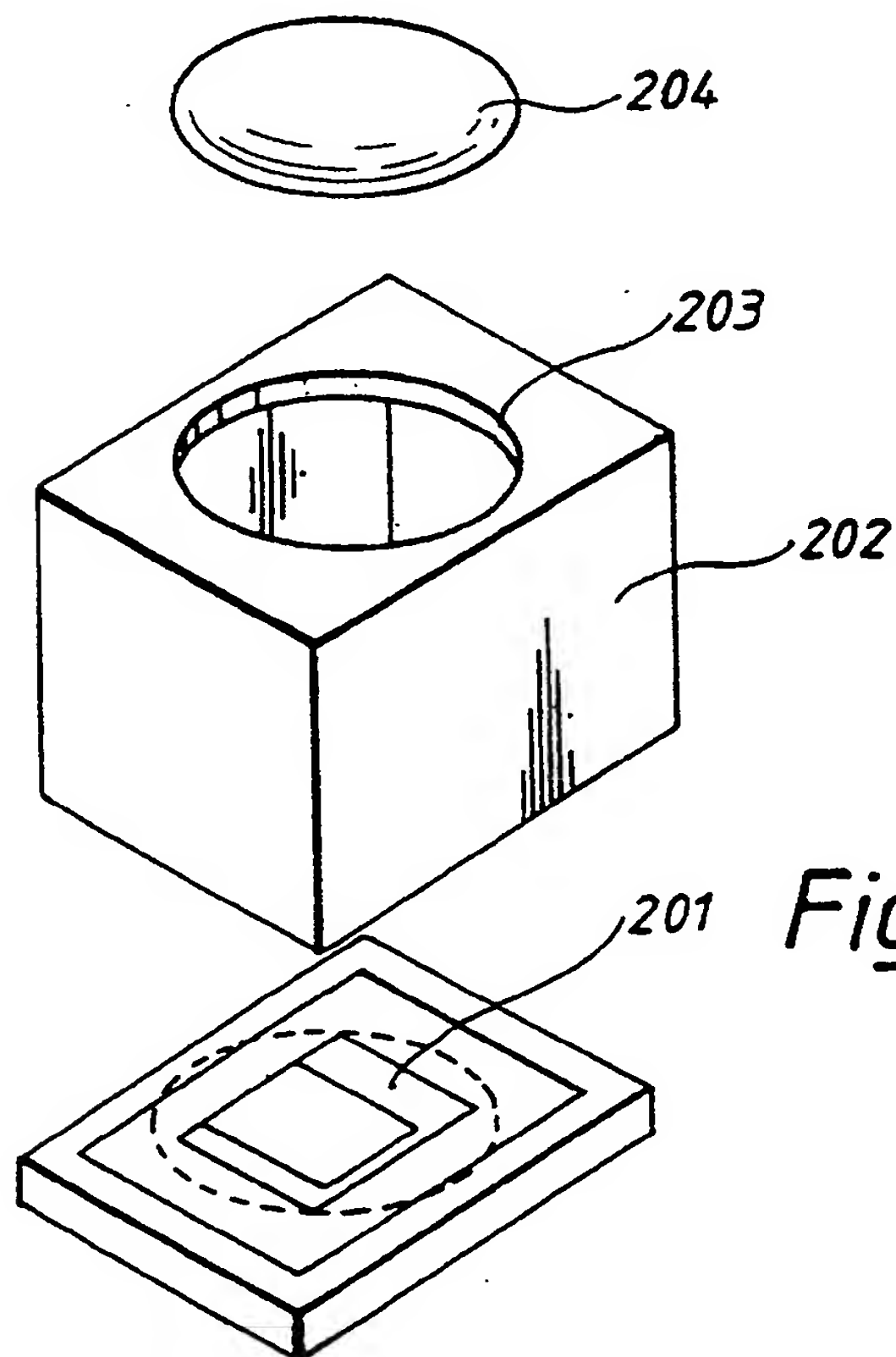


Fig. 7.

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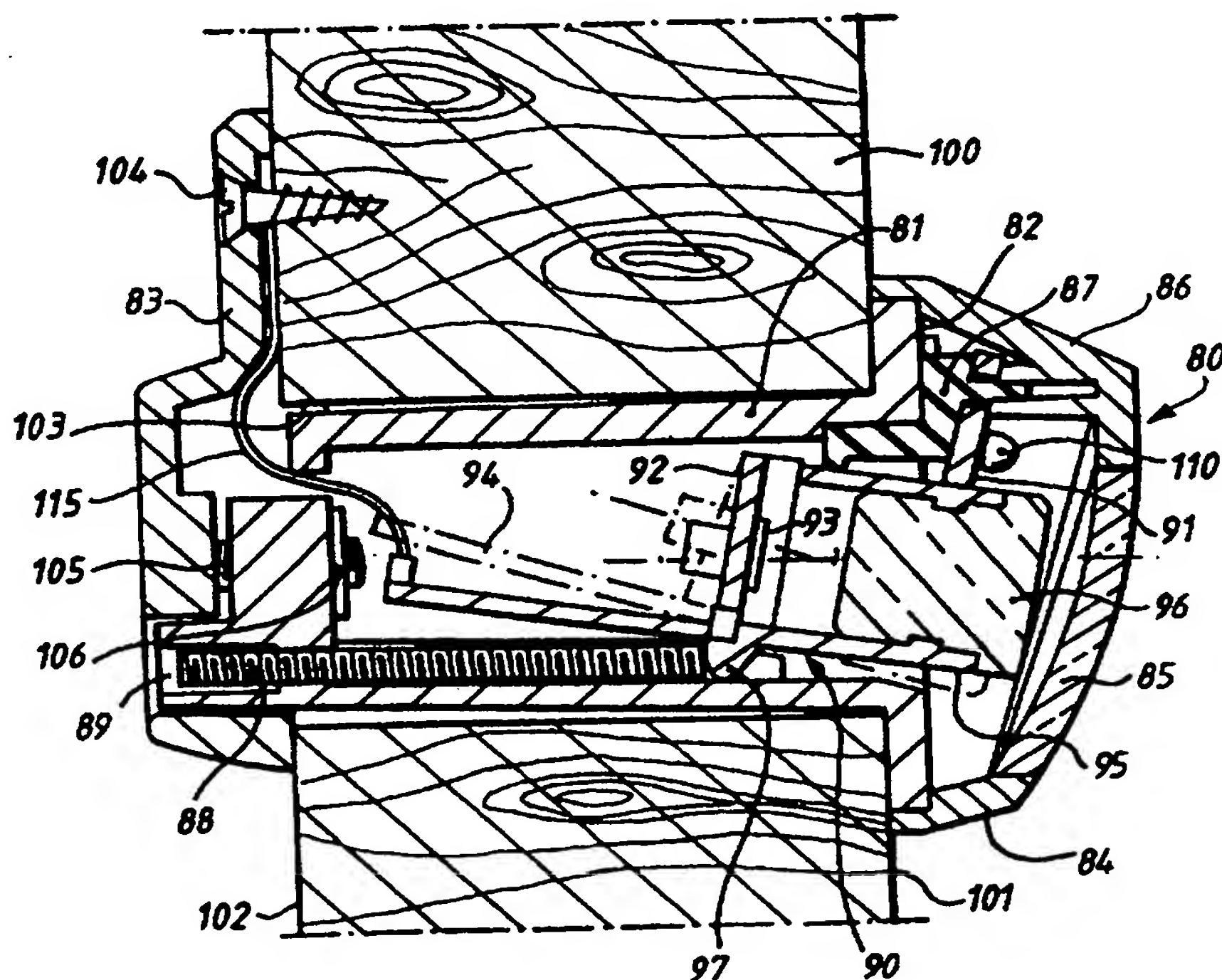
(88) Date of publication of the international search report:

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(54) Title: MINIATURE CAMERAS

## (57) Abstract

A miniature camera (80) is fitted to a door (100), and comprises an elongate tubular housing (81) which extends between an outer face (101) and an inner face (102) of the door (100). An annular flange (82) is formed at one end of the housing (81), and bears against the outer face (101) of the door (100). An end cap (83) is secured to the inner door face (102) by means of a wood screw (104), and is connected to the housing (81) by means of a bolt (105). A cover (84) is provided with a transparent portion (85), and engages the housing (81) in a substantially waterproof and weatherproof manner. Mounted within the tubular housing (81) is a chassis member (90), which cooperates with a resilient member (87). Mounted on the chassis (90), substantially at right angles thereto, is a circuit board (92) which carries a CMOS/APS image sensor (93). A second circuit board (94) is also mounted on the chassis member (90), and extends in a direction generally parallel to the axis of extent of the chassis member (90). An adjusting screw (88) is mounted at the lower part of the tubular housing (81), and engages a projection (97) to adjust the angle of inclination of the chassis member (90), against a resilient bias of the resilient member (87). Cameras of other configurations are disclosed in the specification.



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## INTERNATIONAL SEARCH REPORT

International Application No  
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IPC 6 H04N5/225 H04N7/18

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 H04N G08B

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Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 197 544 (SONY CORP) 15 October 1986 see page 4, line 27 - page 6, line 20 see figures 3-6 ---	1-7
A	US,A,4 524 384 (LEFKOWITZ STEPHEN ET AL) 18 June 1985 see column 3, line 18 - line 42 see column 5, line 31 - column 7, line 62 ---	1-7
A	PATENT ABSTRACTS OF JAPAN vol. 015, no. 159 (E-1059) 22 April 1991 & JP,A,03 030 582 (TOSHIBA LIGHTING & TECHNOL CORP) 8 February 1991 see abstract ---	1-7
A	US,A,3 482 037 (MARIE VAN BRITTAN BROWN) 2 December 1969 see column 3, line 30 - column 5, line 40 --- -/--	1-7

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## INTERNATIONAL SEARCH REPORT

Inter national Application No

PCT/GB 95/01382

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 095 (E-395) 12 April 1986 & JP,A,60 236 593 (SHARP KK) 25 November 1985 see abstract ---	1-7, 26-28,30
A	PATENT ABSTRACTS OF JAPAN vol. 012, no. 357 (E-662) 26 September 1988 & JP,A,63 114 376 (CANON INC) 19 May 1988 see abstract ---	5
X	US,A,5 079 629 (OZ DAN) 7 January 1992 ---	18, 22-24, 27,28 30
A	see column 2, line 45 - column 4, line 24 ---	
A	DE,U,86 29 399 (ERHARDT & LEIMER GMBH) 29 January 1987 see page 5, line 21 - page 8, line 21 ---	18,27, 28,30
A	EP,A,0 230 473 (MATSUSHITA ELECTRIC WORKS LTD) 5 August 1987 see page 11, line 31 - page 13, line 12 ---	21,26
A	DE,U,93 07 023 (LEOPOLD SCHARPF) 5 August 1993 see page 4, line 6 - page 5, line 18 ---	25
X	EP,A,0 585 186 (EASTMAN KODAK CO) 2 March 1994 see column 3, line 32 - column 4, line 16 see column 8, line 16 - column 9, line 58 ---	29
A	EP,A,0 541 449 (SONY CORP) 12 May 1993 see column 3, line 44 - column 4, line 39 see column 5, line 12 - line 27 see figures 1,2,7 ---	1-7,18, 27,28,30
A	US,A,5 274 456 (IZUMI AKIYA ET AL) 28 December 1993 see column 1, line 45 - column 2, line 23 see figures 2A,7,9 ---	1-7,19, 20,29
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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 95/01382

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>LASER FOCUS WORLD, vol.29, no.6, 1 June 1993, TULSA, USA pages 83 - 87 ERIC R. FOSSUM 'Active-pixel sensors challenge CCDs' cited in the application see page 83, middle column, line 24 - page 84, left column, line 4 see page 86, right column, line 1 - line 10</p> <p>-----</p>	19,20

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/GB95/01382

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see continuation sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-7, 18-30

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.



# INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB95/01382

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210 box II

1. claims 1-7,19-28,30 (as far as they depend on any of claims 1-7):  
Camera adapted to be mounted in a panel having first and second faces.
2. claims 8-16,19-28,30 (as far as they depend on any of claims 8-16):  
Camera having an image sensor mounted on a circuit board in an egg-shaped housing.
3. claims 17,19-28,30 (as far as they depend on claim 17):  
Image sensor assembly for a miniature camera having an image sensor, a video processor, an audio processor and a voltage regulator mounted on a printed circuit board.
4. claims 18,19-28,30 (as far as they depend on claim 18):  
Image sensor assembly for a miniature camera having an image sensor mounted in a printed circuit board of substantially circular shape.
5. claim 29:  
Sensor assembly comprising an image sensor mounted on a printed circuit board and lens holder that engages the circuit board and holds a lens at a predetermined distance from the sensor.
6. claims 31-38:  
Surveillance system.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter national Application No

PCT/GB 95/01382

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0197544	15-10-86	JP-A- 61249028 CA-A- 1282860 US-A- 4750011	06-11-86 09-04-91 07-06-88
US-A-4524384	18-06-85	NONE	
US-A-3482037	02-12-69	NONE	
US-A-5079629	07-01-92	DE-D- 69203251 EP-A- 0498756 IL-A- 100752 JP-A- 4336026	10-08-95 12-08-92 26-08-94 24-11-92
DE-U-8629399	29-01-87	NONE	
EP-A-0230473	05-08-87	JP-A- 61296874 JP-A- 62038688 JP-A- 62038689 JP-A- 62038690 AU-B- 6121886 DE-D- 3689631 DE-T- 3689631 WO-A- 8700384 US-A- 4843461	27-12-86 19-02-87 19-02-87 19-02-87 30-01-87 24-03-94 19-05-94 15-01-87 27-06-89
DE-U-9307023	05-08-93	NONE	
EP-A-0585186	02-03-94	US-A- 5302778 JP-A- 6177271	12-04-94 24-06-94
EP-A-0541449	12-05-93	JP-A- 5130469 JP-A- 5137034 US-A- 5381176	25-05-93 01-06-93 10-01-95
US-A-5274456	28-12-93	JP-A- 1303971 JP-A- 2027878 JP-A- 1175372 US-A- 5400072	07-12-89 30-01-90 11-07-89 21-03-95